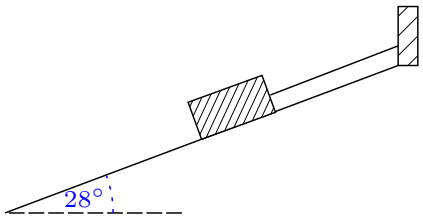
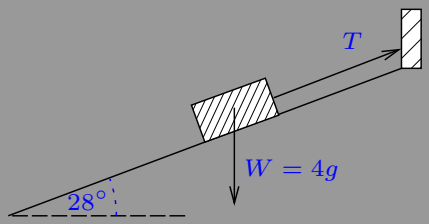
Basic Slope Problems

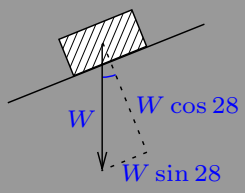
i. **A weight of 4kg is at rest on a smooth slope of 28°. The weight is held in place by a light string which is attached to a wall at the top of the slope. Find the tension in the string.**



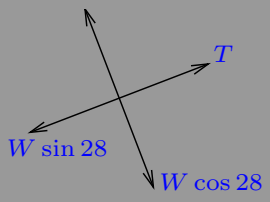
Solution: Firstly, we should add the forces we are told in the question to complete our diagram. Remember a mass of 4kg will have a gravitational force (weight) of $(4 \times 9.8)N = 39.2N$



Now we need to resolve the forces into their components acting parallel and perpendicular to the slope. From SOHCAHTOA, we can break the weight into the components $W \sin 28$ and $W \cos 28$.



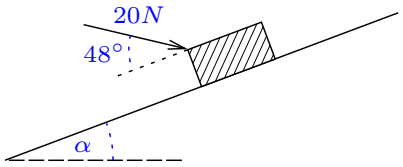
Hence, we obtain the simplified diagram:



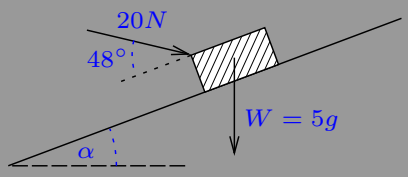
Since our mass is at rest (in equalibrium), the forces acting parallel to the slope must be equal i.e. $T = W \cos 28$. Since $W = 39.2$, we have,

$$T = 39.2 \times \sin 28 = 18.4N$$

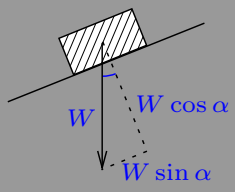
ii. **A parcel of mass 5kg lies on a smooth plane inclined at an angle α to the horizontal. The parcel is held in equilibrium by a force of magnitude 20N acting at 48° to the plane, as shown. Find the value of α.**



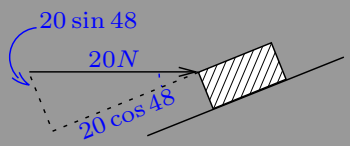
Solution: Firstly, we need to add the forces we are told in the question to complete our diagram. Remember a mass of 5kg will have a gravitational force (weight) of $(5 \times 9.8)N = 49N$



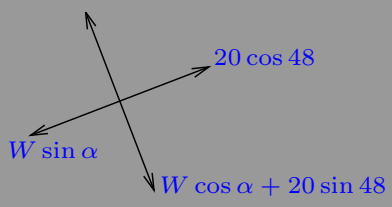
Now we need to resolve the forces into their components acting parallel and perpendicular to the slope. From SOHCAHTOA, we can break the weight into the components $W \sin\alpha$ and $W \cos\alpha$.



Similarly, we can break the horizontal force into:



Hence, we obtain the simplified diagram:



Since our mass is at rest (in equalibrium), the forces acting parallel to the slope must be equal i.e. $W \sin\alpha = 20\cos 48$. Since $W = 49$, we have,

$$\sin\alpha = \frac{20\cos 48}{49} \approx 0.273 \implies \alpha = 15.85°$$

